**PERIODIC TABLE**

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## MODEL OF ATOMIC STRUCTURE

Fattah (2012) proposed a visualized mathematical model of atomic structure [7]. Figure 1 (a) represents a simple visualized atom's parabaloid shells containing the inside orbits. Each parabolic shell, n > 1, contains an orbit of a unity diameter, atomic unit length, with its centre at the focus of the parabola. At distances from that orbit, in a sequence of 1/4 atomic unit length (a.u.l.) along nucleus axis, the shell contains a number of smaller concentric orbits toward the nucleus (the origin). The capacity of each orbit is two electrons. A section through the y-axis is shown in figure 1 (b).

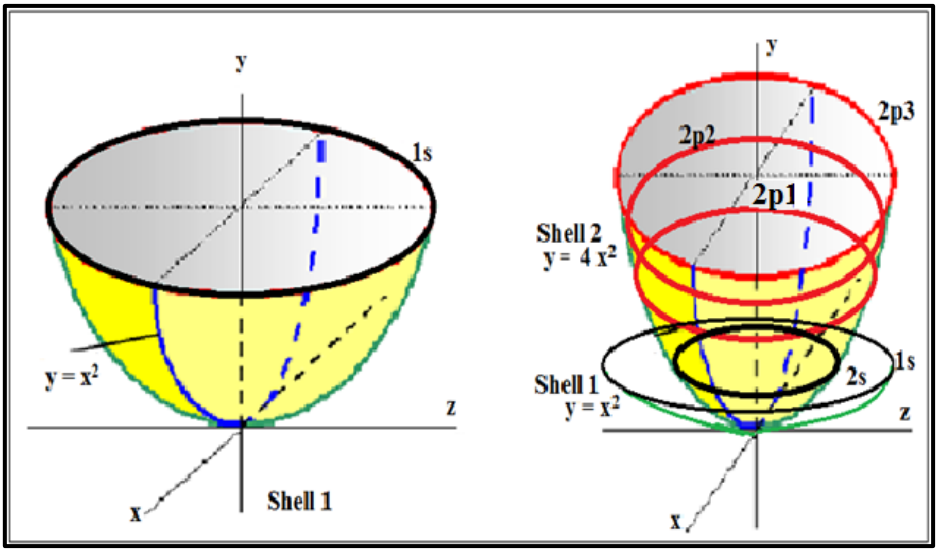


Fig. 1 (a) simple visualized atom's shells

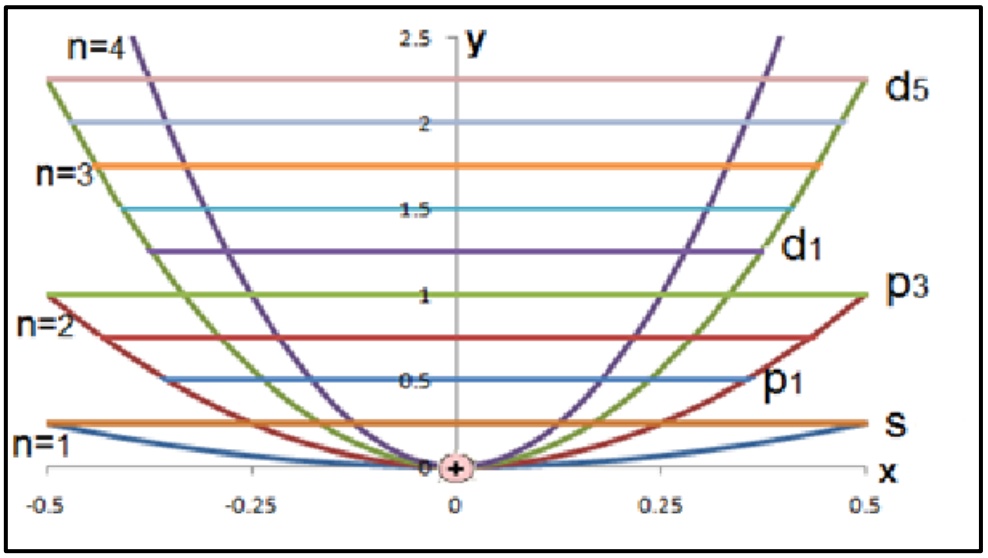


Fig. 1 (b) A Section Through the y-axis

The atom shell equation is given as a parabola:

$$y = n^2\, x^2 \qquad (1)$$

Where *n* is the number of the shell. Table (1) shows the properties of the shells.

Table (1) Properties of the Atom's Shells

| **Shell No. (n)** | **Shell Equation** | **Focus a.u.l.** | **Electrons Capacity** | **No. of Orbits** | **Types of Orbits in the Shell** |
|---|---|---|---|---|---|
| 1 | $y = x^2$ | 1/4 | 2 | 1 | 1s |
| 2 | $y = 4x^2$ | 1 | 8 | 4 | 2s , $2p_{1-3}$ |
| 3 | $y = 9x^2$ | 9/4 | 18 | 9 | 3s , $3p_{1-3}$, $3d_{1-5}$ |
| 4 | $y = 16x^2$ | 4 | 32 | 16 | 4s , $4p_{1-3}$, $4d_{1-5}$, $4f_{1-7}$ |
| 5 | $y = 25x^2$ | 25/4 | 50 | 25 | 5s , $5p_{1-3}$, $5d_{1-5}$, $5f_{1-7}$ , $5g_{1-9}$ |

Obviously, it is noticed that when the $p_3$ – orbits are filled with two electrons, the position of next electron will be in the higher inner shell. Consequently, the core electrons, those are complete in the $p_3$- orbits, represents end of filling the shell. These represent the noble gases elements. In addition, it can also be noticed that the difference in number of electrons for each two successive elements in the noble gases group takes a specific sequence. Table 2 shows these differences and the sequence of the formulae governing it.

Table (2)

| **Shell** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|---|---|---|---|---|---|---|---|
| **No. Electrons** | **2** | **10** | **18** | **36** | **54** | **86** | **118** |
| **Difference** | | **8** | **8** | **18** | **18** | **32** | **32** |
| **Formula** | | $\mathbf{2*2^2}$ | $\mathbf{2*2^2}$ | $\mathbf{2*3^2}$ | $\mathbf{2*3^2}$ | $\mathbf{2*4^2}$ | $\mathbf{2*4^2}$ |

Considering the above derived sequence of these formulae, a new configuration of electrons can be developed. Distribution of electrons in the orbits is traced in table 3.

Table (3) Filling Orbits in the Atom's Shells

| No. of shells | Types of orbits in shells * | | | | | | | | | | | | | No. of orbits in Shells | No. of filled orbits | No. of empty orbits | No. of electrons in filled orbits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | s | p | d | f | g | h | j | → | | | | | | | | | |
| 1 | 1 | | | | | | | | | | | | | 1 | 1 | 0 | 2 |
| 2 | 2 | 3 | | | | | | | | | | | | 5 | 5 | 0 | 10 |
| 3 | 3 | 6 | 5 | | | | | | | | | | | 14 | 9 | 5 | 18 |
| 4 | 4 | 9 | 5+5 | 7 | | | | | | | | | | 30 | 18 | 12 | 36 |
| 5 | 5 | 12 | 10+5 | 14 | 9 | | | | | | | | | 55 | 27 | 28 | 54 |
| 6 | 6 | 15 | 15+5 | 7+14 | 18 | 11 | | | | | | | | 91 | 43 | 48 | 86 |
| 7 | 7 | 18 | 20+5 | 14+14 | 27 | 22 | 13 | | | | | | | 140 | 59 | 81 | 118 |
| 8 | 8 | 21 | 25+5 | 21+14 | 9+27 | 33 | 26 | 15 | | | | | | 204 | 84 | 120 | 168 |
| 9 | 9 | 24 | 30+5 | 28+14 | 18+27 | 44 | 39 | 30 | 17 | | | | | 285 | 109 | 176 | 218 |
| 10 | 10 | 27 | 35+5 | 35+14 | 27+27 | 11+44 | 52 | 45 | 34 | 19 | | | | 385 | 145 | 240 | 290 |
| 11 | 11 | 30 | 40+5 | 42+14 | 36+27 | 22+44 | 65 | 60 | 51 | 38 | 21 | | | 506 | 181 | 325 | 362 |
| 12 | 12 | 33 | 45+5 | 49+14 | 45+27 | 33+44 | 13+65 | 75 | 68 | 57 | 42 | 23 | | 650 | 230 | 468 | 460 |
| 13 | 13 | 36 | 50+5 | 56+14 | 54+27 | 44+44 | 26+65 | 90 | 85 | 76 | 63 | 46 | 25 | 819 | 279 | 540 | 558 |

* Orbits filled with two electrons

Figure 2 shows a graphical relation between the number of shells and the number of electrons in the filled orbits

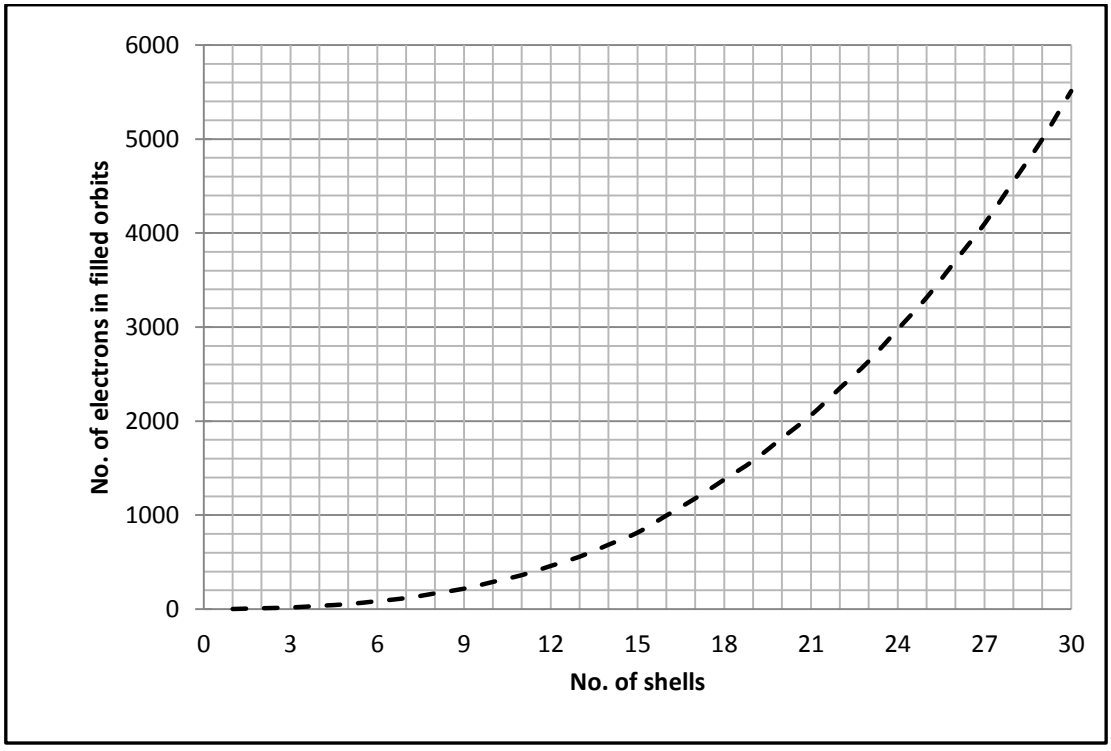


Fig. 2 Relation between the Number of Shells and the Number of Electrons in the Filled Orbits

## MODEL OF PERIODIC TABLE

The periodic table is always constructed along two dimensions: Periods and groups. In this simulation, the periodic table is constructed in accordance to the electrons configuration. The visualized parabaliod shape, Fattah (2012) model of atomic structure, is the basis of the simulation. The number of electrons of an element specifies the position of the element in the periodic table. In other words, the visualized periodic table locates the elements according to the position of the last electron of an element in the specific orbit in a certain shell.
Figure 3 shows the new invention of the periodic table of the ordinary known elements. The known main groups and the transition elements are presented in a new presentation. Each element, based on electrons number, is located in a specific orbit in its shell.

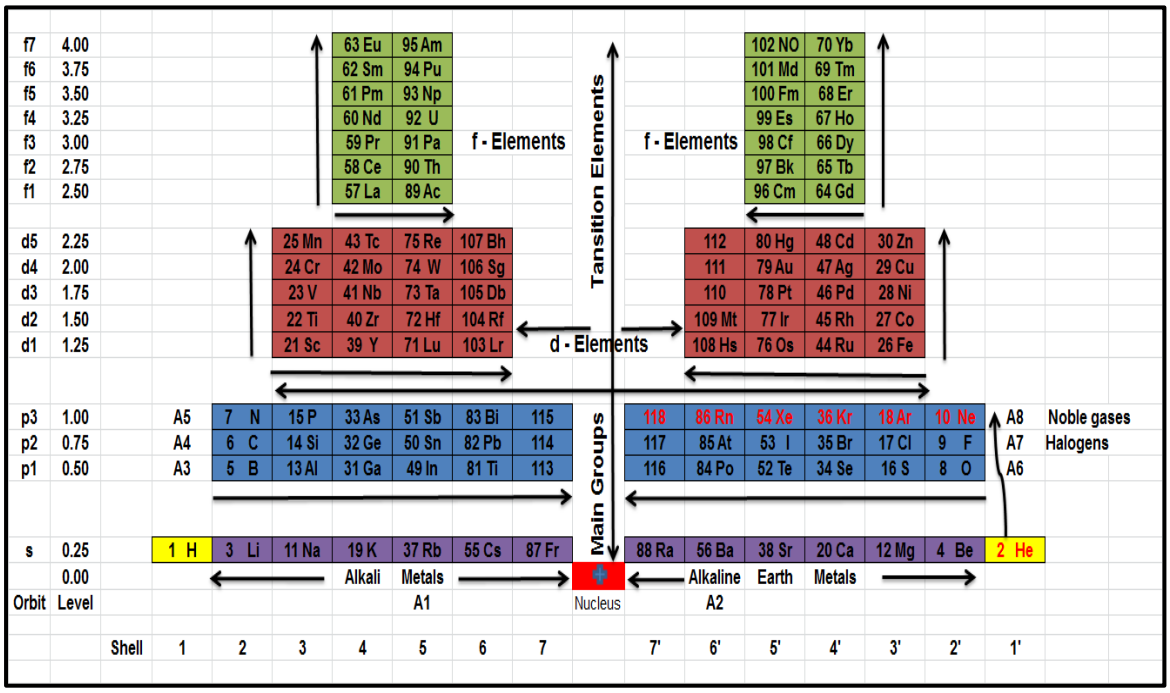


Fig. 3 Simulated Periodic Table (7 Shells)

This model represents a flexible simulation of the periodic table of elements. Simply, inner shells and additional orbits can be inserted. This will enable revealing of new elements and to predict unknown elements of known properties. Figure 4 and figure 5 represents periodic tables of 168 elements in 8 shells and 362 elements in 11 shells respectively. More elements in higher shells can be simulated.

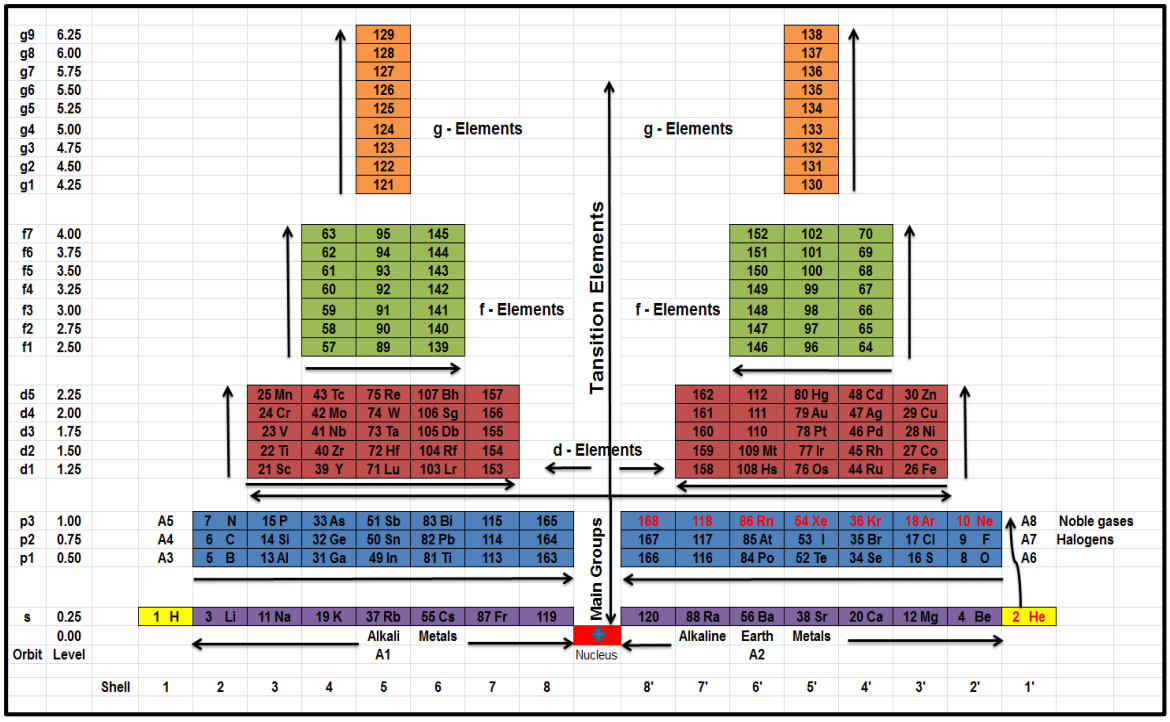


Fig. 4 Simulated Periodic Table (8 Shells)

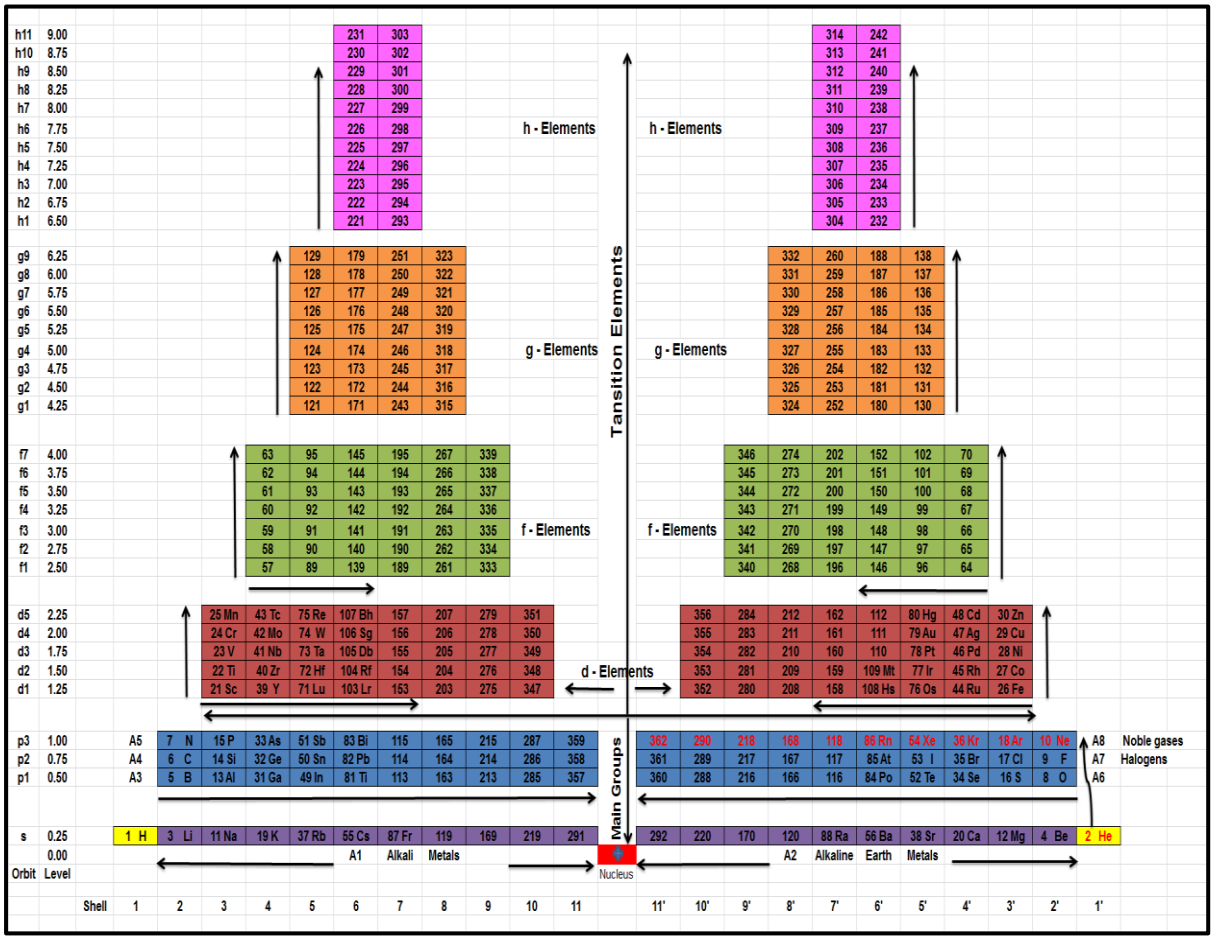


Fig. 5 Simulated Periodic Table (11 Shells)